1855MNRAS..15..216.

Report of the Astronomer Royal to the Board of Visitors, read at the Annual Visitation of the Royal Observatory, Greenwich, 1855, *June* 2.

The following are a few extracts from this Report:—

"The Twentieth of the Reports which I have had the honour to present to the Board of Visitors will, I trust, be received with indulgence, less on account of the importance of the history which it is to convey, as applying to a year in which no changes of great consequence have been made, than for the numerical place which it occupies in the series of Annual Documents. The date to which the statements of the Report apply is 1855, May 15; and the interval embraced in its historical portion is that between 1854, May 26, and 1855, May 15.

"*Astronomical Instruments.*—On the transit-circle, I have only to remark that it is in perfect order, and continues to give the greatest satisfaction to all the observers.

"The transit-circle at the observatory of the Cape of Good Hope (constructed generally on the pattern of that at Greenwich, with some improvements) is mounted, and is, I believe, in full work. It seems to be quite satisfactory to Mr. Maclear.

"The reflex zenith tube is general good order.

"No alteration has been made in the altazimuth.

"The barrel-apparatus, for the register of transits by punctures produced by galvanic communication, has been in constant use without suffering injury, except in the parts exposed to continual friction, which require occasional attention. The method of giving the time-second-signals from the transit-clock, which I I described in my last Report, is found to be perfectly successful. The insulation of the touch-apparatus has sometimes failed in very damp weather; but, when the sky has cleared, the moistened gutta-percha has become dry and the insulation perfect, so speedily that very few transits have been lost.

"The rest of the galvanic apparatus is, in most respects, in the same state as at the last meeting of the Visitors. In the galvanic magnet for dropping the time-signal-ball, it has been found desirable to guard against the risk of permanent magnetism, by causing the apparatus itself to reverse the poles of the battery at every drop of the ball. When arrangements were originally made for exhibiting the London currents upon the transit-clock needle, and for sending currents to and through London by the touch apparatus of the transit-circle, in order to avoid disturbing the ground, I so connected the wires by turn-plates that one of the wires of the barrel-apparatus was used for these purposes; but with the increased facilities which I now possess for laying wires, I intend to make the barrel-apparatus-wires entirely independent of the others,—preserving, however, the power of connecting the touch-apparatus with the London and foreign wires.

"*Astronomical Observations.*—The well-understood system

1855MNRAS..15..216.

of meridional observations of stars remains unaltered, each of the stars in the extended standard list being observed, if possible, twenty times in three years. The moon is observed on the meridian at every opportunity, without exception. In the observation of planets a slight relaxation has been made, which the increased number of those bodies rendered necessary. The small planets are not observed at all in the morning watch (from 3^h A.M. to daylight), and the large planets are not observed then except in company with the moon. With this qualification, the sun and planets are observed on the meridian at every opportunity, except on Sundays.

"The whole number of meridional observations from 1854, May 26, to 1855, May 15, is nearly as follows (an observation of two limbs, or a duplicate transit by eye and ear, and by touch-apparatus, being reckoned as two):—In the transit department; transits, 4680; observations of collimators by means of the transit-telescope, 302; observations of transit-wires by reflexion, 302; observations of one collimator by the other, 52: in the meridian-circle department; observations of all kinds, 4565.

"The number of days on which γ *Draconis* has been observed with the reflex zenith tube is 51.

"With the altazimuth, the number of days of complete observations of the moon during 12 lunations is 178, or 14·8 per lunation, while with the transit-circle the number has been 97, or 8·1 per lunation. The sky has evidently been less favourable than usual; the failing has taken place principally in the spring of the present year. Of the altazimuth observations, 0 are on days when the moon passed the meridian between 0^h and 1^h solar time, 2 between 1^h and 2^h, 4 between 2^h and 3^h, 3 between 21^h and 22^h, 2 between 22^h and 23^h, 2 between 23^h and 24^h. There are no observations on the meridian corresponding to these. The whole number of separate observations of the moon and stars with the altazimuth is 878, and the whole number of observations of its collimator is 604. The observations have been conducted exactly as in the last years.

"The following remarks on the result of the reductions may not be without interest:—

"During the whole time of which I have spoken, the galvanic-contact method has been employed for transits, with the exception of a few days, when the galvanic apparatus was out of order. From the clock-errors, I have deduced the personal equations of the observers in our usual way; not by making special experiments, in which I have very little confidence, but by taking the transits as we find them, and discussing them on the supposition that the clock-rate has been very steady; a supposition in the adoption of which we are amply justified by the comparison of the clock-errors. The result is, that the magnitude of the personal equations in the galvanic-touch method is not above half of that in the eye-and-ear method.

"In former communications to the Visitors, I have alluded to

1855MNRAS..15..216.

the constancy of relation between the azimuths of the transit-circle and of the collimators, while all seem to change with respect to the heavens. Other instances of the same thing have occurred from time to time, and have left upon the minds of the computers the impression that there is a real change in the position of the ground. I need not remark that such a conclusion can be received as valid only after very careful and complete discussion.

" *Chronometers, Communication of Time, and Operations for Longitude.*—The number of chronometers now on hand is about sixty; twenty of these being on trial for purchase. They are compared, some every day and some every week, and occasionally in extreme temperatures; the repairs of those which belong to the Government are managed; and weekly reports of rates, and monthly reports of repairs, are made to the Admiralty.

" The system of galvanic normal clock and sympathetic clocks is in the state described in the last year's Report; with this difference only, that the wires to the clock at the Hospital Schools, instead of being suspended across the Park, are carried underground. The clock at the London Bridge Station is made to distribute the galvanic hourly signals to the Electric Telegraph Company's wires and to the different branches of the South-Eastern Railway wires.

" The time-signal ball at Deal was brought into regular use at the beginning of the present year. In a short time, however, its action was interrupted, partly by derangement of the apparatus, and partly by the severity of the weather, which froze the sulphuric acid to the state of jelly. I sent an assistant and workman to put it in order, and since that time it has generally acted very well. Since March 2 there have been three failures; one of these arose from the ball hanging on the clips, which were not properly oiled, and one from the turning off of the current on the Railway line; the cause of the third has not been traced out with certainty. The success or failure of the drop is known immediately at Greenwich; as the Deal ball, at the termination of its fall, so alters the connexions of wires that a signal is sent to the Observatory. A register is kept in a prescribed form in the Ball-Tower at Deal, and copies of this are sent to the Observatory, leaf by leaf, as soon as they are filled. These cautions I consider to be absolutely necessary for maintaining the regular action of the mechanism under rather difficult circumstances. The whole system is so successful that I have no hesitation in recommending its extension to the Government.

" Application has been made to me from one of the important offices of Government, for the galvanic regulation of their clocks. On considering the risks to which various galvanic communications are liable, and the financial necessity for occupying wires as little as possible, I perceived that it was necessary to devise constructions which should satisfy the following conditions. First, that a current sent once a-day should suffice for adjusting the clock, even if it had gone ten or more seconds wrong. Secondly,

1855MNRAS..15..216.

that an occasional failure of the current should not stop the clock. I have arranged constructions which possess these characters, and the artist (Mr. C. Shepherd) is now engaged in preparing estimates of the expense. I think it likely that this may prove to be the beginning of a very extensive system of clock regulation.

"I have commenced examination of observations and preparation of skeleton forms for the extension of lunar reductions.

"*General Remarks.*—A fair examination of the statements already made will show how much our real disposable force has been weakened, by accidental circumstances, during the last year. Two Assistants were absent for a month on the Pendulum expedition, and the whole of the extensive calculations which followed were made in the Observatory. One Assistant was employed for some time at Deal, another being at the same time partially occupied in London. The longitude of Paris required the absence of an Assistant for some weeks, and threw a great mass of calculation upon us. For mounting the model of the transit-circle at the Exhibition in Paris, one Assistant has been employed in Paris (with four workmen) for a month. It is under these pressures that I have been obliged to require the assistance of supernumeraries for observations—an assistance which I have been compelled to purchase by the sacrifice of part of their time, otherwise available for computation.

"At the same time, I view the progress of our ordinary work cheerfully. We have effectually maintained the mastery over it; and, if no special cause interrupts us, we shall in a few months have brought everything to the most forward condition in which it is practicable to keep it.

"For the rest, the general policy of the Astronomical Observatory has been the same as during the last twenty years; to leave the equatoreal and scrutinizing departments of Astronomy to other Observatories, but to spare no expense in instruments, no pains in observation, and no labour in reduction, on standard meridional observations generally, and on meridional and extrameridional observations of the moon in particular. And I would fain hope that the *Greenwich Observations* have assumed such a shape, that the Astronomer who may desire to find fundamental determinations of the sun's path, of the places of an extensive catalogue of stars, and of the varying positions of all the moving bodies of the solar system, presented in the utmost extent and fulness, and accuracy, may meet with all that he desires in those volumes."

There were exhibited at the meeting of the Society two beautiful engravings,—one representing two views of *Mars* and the other a view of *Saturn,*—executed from drawings by Captain Jacob, founded upon his own observations of those planets at Madras with the Lerebours equatoreal. One of the views of *Mars* represents the aspect of the planet on the 18th of March,

1855MNRAS..15..220N

1854, at $9^h\ 30^m$ Madras Mean Time; the other represents its appearance on the 23d of March, 1854, at $6^h\ 54^m$. The drawing of *Saturn* refers to the appearance of the planet on the 15th of November, 1852. The transparency of the obscure ring which was first remarked by Captain Jacob and Mr. Lassell, independently of each other, is very clearly exhibited in this drawing. The drawings of both planets have been engraved at the expense of the Court of Directors of the East India Company, who have liberally distributed copies of them to the Fellows of the Society and other persons interested in the subject of such delineations. A few copies still remain for distribution, which may be obtained by applying at the Apartments of the Society.

Suggestions respecting the Origin of the Rotatory Movements of the Celestial Bodies and the Spiral Forms of the Nebulæ as seen in Lord Rosse's Telescopes. By James Nasmyth, Esq.

" What first set me thinking on this subject was the endeavour to get at the reason why water in a basin acquires a rotatory motion when a portion of it is allowed to escape through a hole in the bottom: Every well-trained philosophical judgment is accustomed to observe illustrations of the most sublime phenomena of creation in the most minute and familiar operations of the Creator's laws, one of the most characteristic features of which consists in the absolute and wonderful integrity maintained in their action whatsoever be the range as to magnitude or distance of the objects on which they operate.

" For instance, the minute particles of dew which whiten the glass-blade in early morn are, in all probability, moulded into spheres by the identical law which gives to the mighty sun its globular form !

" Let us pass from the rotation of water in a basin to the consideration of the particles of a nebulous mass just summoned into existence by the fiat of the Creator,—the law of gravitation coexisting.

" The first moment of the existence of such a nebulous mass would be inaugurated by the election of a centre of gravity, and, instantly after, every particle throughout the entire mass of such nebulæ would tend to and converge towards that centre of gravity.

" Now let us consider what would be the result of this. It appears to me that the inevitable consequence of the convergence of the particles towards the centre of gravity of such a nebulous mass would not only result in the formation of a nucleus, but by reason of the physical impossibility that all the converging particles should arrive at the focus of convergence in directions perfectly radial and diametrically opposite to each other, however slight the degree of deviation from the absolute diametrically opposite direction in which the converging particles coalesce at